

1-3-2011

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Citation

Das JP, Chew N, Kitt E, Murphy C, O'Rourke J, Power M, McConkey SJ. Extra-corporeal membrane oxygenation in the management of 2009 influenza A (H1N1) refractory respiratory failure. *Irish Medical Journal*. 2011;104(3):90-1.

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Extra-Corporeal Membrane Oxygenation in the Management of 2009 Influenza A (H1N1) Refractory Respiratory Failure

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Ir Med J. 2011 Mar;104(3):90-1.

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Abstract

Rapidly progressive acute respiratory failure attributed to 2009 H1N1 influenza A infection has been reported worldwide¹⁻³. Refractory hypoxaemia despite conventional mechanical ventilation and lung protective strategies has resulted in the use a combination of rescue therapies, such as conservative fluid management, prone positioning, inhaled nitric oxide, high frequency oscillatory ventilation and extracorporeal membrane oxygenation (ECMO)⁴. ECMO allows for pulmonary or cardiopulmonary support as an adjunct to respiratory and cardiac failure, minimising ventilator-associated lung injury (VALI). This permits treatment of the underlying disease process, while concurrently allowing for recovery of the acute lung injury. This case documents a previously healthy twenty-two year old Asian male patient with confirmed pandemic (H1N1) 2009 influenza A who was successfully managed with ECMO in the setting of severe refractory hypoxaemia and progressive hypercapnia.

Case Report

A 22 year old previously healthy Chinese student presented to the Emergency Department with a 6 day history of worsening dyspnoea, myalgia and general malaise. On examination he was found to be pyrexia (38.5°C), hypotensive (100/67 mmHg) and pulse oximetry recorded oxygen saturations of 78% on room air. His admission chest radiograph (Figure 1) showed bilateral middle and lower zone consolidation and arterial blood gas sample confirmed severe hypoxaemia (PaO₂ 5.9 kPa). The patient was promptly transferred to the Intensive Care Unit for invasive ventilatory and vasopressor support. Oseltamivir was commenced for confirmed pandemic H1N1 2009 influenza A infection, in addition to piperacillin/tazobactam, and clarithromycin for community-acquired pneumonia.

Figure 1: Admission Chest Radiograph



Over the course of 8 days, the patient developed progressive worsening multiorgan failure requiring a protective lung ventilator strategy for severe acute respiratory distress syndrome (ARDS), ongoing vasopressor support, in addition to continuous renal replacement therapy. In the setting of refractory hypoxaemia and progressive hypercapnia with conventional ventilatory support (Murray Score 3.25, pH 7.23), the patient was transferred to the Karolinska Institute, Stockholm, Sweden for ECMO. The patient was initially treated with veno-venous ECMO but subsequently converted to veno-arterial ECMO with nitric oxide secondary to venous stasis and right ventricular failure. Complications during the course of ECMO treatment included spontaneous haemothorax requiring a thoracotomy, and ongoing gastrointestinal bleeding prompting cessation of ECMO support on Day 11. The patient was gradually weaned off pressure support ventilation over a 16 day period, and transferred back to Dublin. The total length of ventilatory support including ECMO was 66 days and hospital stay was 78 days. He recovered well with physical rehabilitation and retained full cognitive function.

Discussion

Since 2009 H1N1 influenza A was first described and identified in Mexico in April 2009 a total of 4,586 laboratory confirmed cases of pandemic (H1N1) influenza have been reported in Ireland (80% of cases aged ≤ 35 yrs)⁵. Of this patient group, 1,069 patients were hospitalized. 77 adult patients required admission to an Intensive Care Unit and there were 14 adult ICU deaths (18% ICU mortality). Observational studies published to date have recorded mortality rates ranging from 14.3%^{2,9} up to 41.4%³. ECMO is a treatment modality shown to be efficacious in the management of neonatal and paediatric cardio-pulmonary failure^{6,7} and is indicated in adults with acute severe respiratory failure refractory to advanced modes of mechanical ventilation. The Extracorporeal Life Support Organisation (ELSO) has reported survival rates of 85%, 74% and 52% in infants, children and adults respectively treated with ECMO for severe Acute Respiratory Distress Syndrome (ARDS)⁵. This treatment technique involves the use a veno-venous (preferred mode) or veno-arterial (required for cardiac support) life support circuit with a membrane oxygenator, and requires heparinisation. Mechanical ventilator settings can then be adjusted to allow for lung rest, with lower respiratory rates, fraction of inspired O₂ and plateau inspiratory pressures (< 25 cm H₂O) minimizing VALI⁸.

An observational study of patients (n=68) with 2009 influenza A-associated ARDS treated with ECMO in 15 ICU's in Australia and New Zealand demonstrated an overall mortality of 21%⁹. Peek et al evaluated the safety, clinical efficacy, and cost-effectiveness of ECMO and established that early transfer to an ECMO centre significantly improved survival without severe disability¹⁰. In the case that we have presented, transfer to the only Irish institution providing a fixed non-mobile ECMO service (Mater Misericordiae University Hospital) was not possible as this facility was at full capacity. Although an invasive and complex procedure, commencing ECMO in a specialised centre should be considered in patients with rapidly progressive acute respiratory failure as a lifesaving measure when conventional mechanical ventilation and adjunctive non-ventilatory strategies have failed.

Acknowledgements

The authors wish to thank Dr Brian Marsh, Department of Intensive Care Medicine, Mater Misericordiae University Hospital for the national dataset 2009 H1N1 influenza A Intensive Care Unit admissions and mortality and Dr. Kenneth Palmér, Extra-Corporeal Membrane Oxygenation (ECMO) Center, Karolinska University Hospital, Stockholm, Sweden for the ECMO protocol in Karolinska.

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References

1. Dawood FS, Jain S, Finelli L, Shaw MW, Lindstrom S, Garten RJ, Gubareva LV, Xu X, Bridges CB, Uyeki TM. Emergence of a novel swine-origin influenza A (H1N1) virus in humans. *N Engl J Med* 2009;360:2605-15
2. Kumar A, Zarychanski R, Pinto R, Cook D, Marshall J, Lacroix J, Stelfox T, Bagshaw S, Choong K, Lamontagne F, Turgeon AF, Lapinsky S, Ahern SP, Smith O, Siddiqui F, Jouve P, Khwaja K, McIntyre L, Menon K, Hutchison J, Hornstein D, Joffe A, Lauzier F, Singh J, Karachi T, Wiebe K, Olafson K, Ramsey C, Sharma S, Dodek P, Meade M, Hall R, Fowler RA; Canadian Critical Care Trials Group H1N1 Collaborative. The Canadian Critical Care Trials Group H1N1 Collaborative: Critically ill patients with 2009 Influenza A (H1N1) infection in Canada. *JAMA* 2009;302:1872-79
3. Perez-Padilla R, de la Rosa-Zamboni D, Ponce de Leon S, Hernandez M, Quiñones-Falconi F, Bautista E, Ramirez-Venegas A, Rojas-Serrano J, Ormsby CE, Corrales A, Higuera A, Mondragon E, Cordova-Villalobos JA for INER Working Group on Influenza. Pneumonia and respiratory failure from swine-origin influenza A (H1N1) in Mexico. *N Engl J Med* 2009; 361: 680 – 689
4. Napolitano L, Park P, Raghavendran K, Bartlett R. Nonventilatory strategies for patients with life-threatening 2009 H1N1 influenza and severe respiratory failure. *Crit Care Med* 2010;38: e73-89
5. H1N1 ECLS Registry <http://www.elseo.med.umich.edu/H1N1Registry.html>
6. Bartlett RH, Roloff DW, Cornell RG, Andrews AF, Dillon PW, Zwischenberger JB. Extracorporeal circulation in neonatal respiratory failure: a prospective randomized study. *Pediatrics*. 1985;76:479-487.
7. Keckler SJ, Laituri Ca, Ostlie DJ, St Peter SD. A review of venovenous and venoarterial extracorporeal membrane oxygenation in neonates and children . *Eur J Pediatr Surg* 2010; 20: 1-4
8. Extracorporeal Life Support Organisation (ELSO) guidelines <http://www.elseo.med.umich.edu/Guidelines.html> (Accessed June 2010)
9. The Australia and New Zealand Extracorporeal Membrane Oxygenation (ANZ ECMO) Influenza Investigators. Extracorporeal Membrane Oxygenation for 2009 Influenza A(H1N1) Acute Respiratory Distress Syndrome *JAMA* 2009;302: 1888-1895
10. Peek GJ, Mugford M, Tiruvoipati R, Wilson A, Allen E, Thalanany MM, Hibbert CL, Truesdale A, Clemens F, Cooper N, Firmin RK, Elbourne D, for the CESAR trial collaboration. Efficacy and economic assessment of conventional ventilatory support versus extracorporeal membrane oxygenation for severe adult respiratory failure (CESAR): a multicentre randomised controlled trial. *Lancet* 2009; 374:1351-1363

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No Author Comments

Acknowledgement

No Acknowledgement

Other References

No Other References